MACHAKOS UNIVERSITY

University Examinations for 2024/2025 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES
DEPARTMENT OF MATHEMATICS, STATISTICS AND ACTUARIAL SCIENCES

SECOND YEAR FIRST SEMESTER EXAMINATION FOR DEGREE IN
BACHELOR OF SCIENCE (MATHS & COMPUTER SCIENCE)
BACHELOR OF SCIENCE (ACTUARIAL SCIENCE)
BACHELOR OF ECONOMICS AND STATISTICS
BACHELOR OF EDUCATION (SPECIAL NEEDS)
BACHELOR OF SCIENCE (MATHEMATICS)
BACHELOR OF EDUCATION (SCIENCE)
BACHELOR OF EDUCATION ARTS

SMA 200: CALCULUS II

DATE: 20TH JANUARY, 2025 **TIME: 8.30 AM – 10.30 AM**

INSTRUCTIONS:
Answer question ***ONE (Compulsory)*** *and* ***any other TWO*** *questions*

QUESTION ONE *(COMPULSORY)* (30 MARKS)

a) Evaluate the integrals

$\int x^2\sqrt{x^3+5}dx$ (3mks)

b) Find the value of the following

i) $\int_2^3 x\sqrt{x-2x}dx$ (3mks)

ii) $\int_0^1 \frac{1}{(4-x^2)^{\frac{3}{2}}}dx$ (4mks)

c) Use trigonometric substitution to evaluate $\int \frac{dx}{\sqrt{a^2-x^2}}dx$ (3mks)

d) Use integration by parts to evaluate $\int e^x cosxdx$ (3mks)

e) Find the area bounded by the curves $y^2 = 4x$ and $x^2 = 4y$ (7mks)

f) Express $\frac{x^3}{x^2-3x+2}$ into partial fractions and hence evaluate $\int \frac{x^3}{x^2-3x+2}dx$ (7mks)

QUESTION TWO (20 MARKS)

a) Show that the reduction formulae for $I_n = \int cos^n x dx$ is
$I_n = \frac{sinxcos^{n-1}x}{n} + \frac{n-1}{n} I_{n-2}$ for $n \geq 2$ and hence evaluate $\int cos^5 x dx$
(12mks)

b) Use appropriate integration techniques to find
i) $\int e^x cosx dx$ (4mks)
ii) $\int \frac{x^3}{x-1} dx$ (4mks)

QUESTION THREE (20 MARKS)

a) Use double angle identities to evaluate $\int cos^4\theta d\theta$ (4mks)

b) Make a suitable substitution to evaluate

i) $\int \frac{1}{1+cosx} dx$ (4mks)

ii) $\int \frac{1}{\sqrt{9+16x-4x^2}} dx$ (4mks)

iii) $\int_0^1 x^2\sqrt{x^3+1} dx$ (4mks)

iv) $\int_0^{\frac{\pi}{2}} xcosx dx$ (4mks)

QUESTION FOUR (20 MARKS)

a) Find the length of the curve $y = 2x^{\frac{3}{2}}$ from $x = 0$ to $x = 1$ (5mks)

b) Find the volume generated by rotating the area bounded by $y = x^2, x = 2$ and $y = 0$ about the $x - axis$ (8mks)

c) Find the area enclosed between the curve $y = x(x-1)(x-2)$ and the $x - axis$ (7mks)

QUESTION FIVE (20 MARKS)

a) Show that $\frac{x^5-x^4-3x+5}{x^4-2x^3+2x^2-2x+1} = x + 1 + \frac{2x+1}{x^2+1} - \frac{2}{x-1} + \frac{1}{(x-1)^2}$ and hence evaluate
$\int \frac{x^5-x^4-3x+5}{x^4-2x^3+2x^2-2x+1} dx$ (12mks)

b) Evaluate

i) $\int sin5\theta cos3\theta d\theta$ (4mks)

ii) $\int tan^5 x sec^4 x dx$ (4mks)